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Determining priority strategies for chili agribusiness development through an integrated strategic analysis framework in Tolitoli District, Indonesia

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[2]Faculty of Economics and Business, Universitas Hasanuddin. Jl. Perintis Kemerdekaan No. Km. 10 Tamalanrea Indah, Tamalanrea, Makassar City 90245, South Sulawesi, Indonesia
[3]Faculty of Agriculture, Universitas Hasanuddin. Jl. Perintis Kemerdekaan No. Km. 10 Tamalanrea Indah, Tamalanrea, Makassar City 90245, South Sulawesi, Indonesia

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Abstract. *Alatas RR, Munir AR, Bahrun AH. 2026. Determining priority strategies for chili agribusiness development through an integrated strategic analysis framework in Tolitoli District, Indonesia. Asian J Agric 10 (1): g100160. https://doi.org/10.13057/asianjagric/g100160.* Chili pepper (*Capsicum* spp.) is a strategic horticultural commodity in Indonesia due to its high consumption level and significant influence on food price stability. In Tolitoli District, despite favorable agroclimatic conditions, chili productivity remains substantially below the provincial average (1.14 ton ha compared with 6.43 ton ha at the provincial level in 2023), while recurring price volatility contributes to regional inflation, reaching 7.21% year-on-year in 2024. These challenges are associated with weak farmer institutions, limited bargaining power, and fragmented agribusiness integration. This study aims to analyze internal and external factors, formulate alternative development strategies, and determine priority strategies for chili agribusiness development in Tolitoli District. A descriptive-exploratory mixed-methods approach was employed, integrating qualitative and quantitative data collected from key stakeholders. Data were analyzed sequentially using the Internal Factor Evaluation (IFE) matrix, External Factor Evaluation (EFE) matrix, Grand Strategy Matrix, and SWOT analysis, followed by prioritization using the Analytical Hierarchy Process (AHP). The results indicate that chili agribusiness development is positioned in Quadrant I of the Grand Strategy Matrix, reflecting a strong competitive position and high growth potential. Institutional support emerges as the most influential criterion in determining strategic priorities. The development of area-based chili production centers, aligned with land potential and market demand, is identified as the top priority strategy. The AHP results demonstrate acceptable consistency, with a consistency ratio (CR) below the threshold of 0.10. These findings highlight the importance of strengthening institutional coordination and promoting integrated, cluster-based agribusiness development to enhance competitiveness, stabilize prices, and ensure long-term sustainability of chili agribusiness in Tolitoli District.

Keywords: AHP, chili agribusiness, institutions, production clusters, Tolitoli District

INTRODUCTION

The agricultural sector plays a strategic role in economic development, particularly in developing countries, due to its contribution to food security, employment, and rural income generation. In Indonesia, agriculture also functions as a stabilizing force in regional economies, especially through horticultural commodities that are directly linked to household consumption and food price dynamics. Chili pepper (*Capsicum* spp.) is one such strategic commodity, characterized by high consumption and strong price sensitivity to short-term supply-demand imbalances. Consequently, chili is frequently associated with food price volatility and regional inflation (Yanuarti and Afsari 2016).

Chili price instability has direct implications for the effectiveness of food stabilization policies. As one of the essential commodities regulated under Indonesian Presidential Regulation No. 71 of 2015, the government is mandated to ensure price availability and affordability. Therefore, strengthening an integrated chili agribusiness system from input provision and cultivation to post-harvest handling and marketing has become a strategic priority in regional agricultural development (Fauziah 2016; Nugrahapsari and Arsanti 2018).

Tolitoli District in Central Sulawesi Province, Indonesia, is endowed with favorable agroclimatic conditions for chili cultivation, including bird's eye chili and curly chili varieties. The availability of agricultural land, labor resources, and relatively stable domestic demand positions chili as a potential leading commodity. However, despite these advantages, the performance of chili agribusiness development in Tolitoli has not yet reached its optimal potential. Although production increased between 2021 and 2023 (Figure 1), productivity remains significantly below the provincial averages, and supply instability continues to contribute to price fluctuations. In 2023, chili productivity in Tolitoli reached only 1.14 tons per hectare, compared to 6.43 tons per hectare at the provincial level. Moreover, price volatility contributed to regional inflation, reaching 7.21% year-on-year in 2024. These conditions indicate that production growth has not been accompanied by systemic improvements in efficiency, coordination, and market stability. This trend underscores the need for stronger institutional coordination and integrated agribusiness management to stabilize supply and reduce price fluctuations.

Structural constraints further limit agribusiness performance. Weak farmer institutions, limited access to market information, and inadequate coordination among agribusiness actors reduce farmers' bargaining power and restrict value-added capture at the farm level. Similar conditions have been identified in other regions, where weak integration among agribusiness subsystems constrains competitiveness and sustainability (Anggorowati et al. 2022). Effective agricultural development requires coordination across upstream input provision, on-farm production, post-harvest management, and downstream marketing within an integrated institutional framework (Juhandi et al. 2023).

Previous studies have explored chili agribusiness development strategies using various analytical tools. SWOT analysis is commonly applied to identify internal and external factors, while the Analytical Hierarchy Process (AHP) is used to prioritize strategic alternatives (Lubis et al. 2019; Patima et al. 2024). Some studies have also combined IFE-EFE with SWOT or AHP to support decision-making processes (Anggorowati et al. 2022; Halim 2022). However, these approaches are often applied in a fragmented manner, without integrating IFE-EFE analysis, the Grand Strategy Matrix, SWOT, and AHP within a single coherent and hierarchical framework. To address this gap, an integrated approach is required to systematically link strategic diagnosis, formulation, and prioritization. In this framework, IFE and EFE matrices facilitate the identification of internal and external factors, the Grand Strategy Matrix determines strategic positioning, SWOT analysis formulates alternative strategies, and AHP enables quantitative prioritization based on expert judgment and consistency testing (Saaty 2008). Furthermore, empirical evidence from regions outside Java Island, including Tolitoli District, remains limited, reinforcing the need for a context-specific and integrated analytical framework.

Accordingly, this study aims to analyze internal and external factors, formulate strategic alternatives, and determine priority strategies for chili agribusiness development in Tolitoli District using an integrated analytical framework combining IFE-EFE, the Grand Strategy Matrix, SWOT, and AHP. To achieve this objective, the study addresses three key questions: (i) What internal and external factors influence chili agribusiness development in Tolitoli District, (ii) What strategic alternatives can be formulated based on the identified strategic position, and (iii) Which strategy should be prioritized to enhance competitiveness, price stability, and long-term sustainability. By applying this integrated approach, the study contributes to the development of multi-criteria strategic decision-making frameworks in agribusiness research and provides evidence-based recommendations for regional agricultural policy.

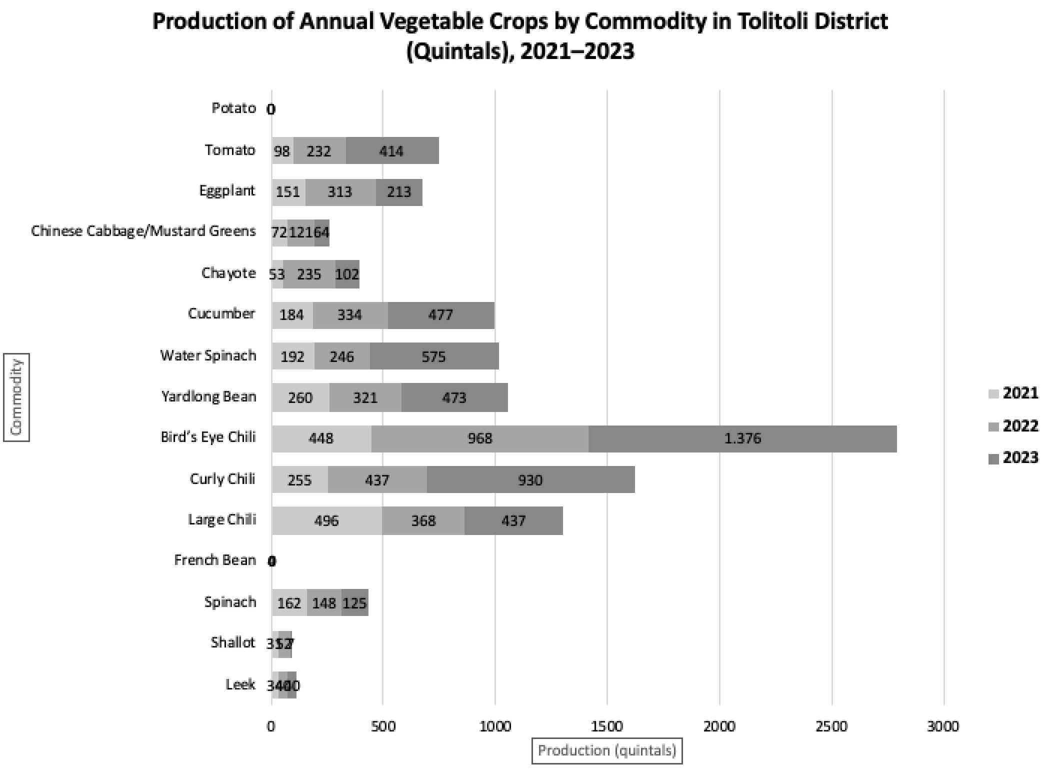

Figure 1. Production of annual vegetable crops by commodity in Tolitoli District, Indonesia (Quintals), 2021-2023. Source: Badan Pusat Statistik (BPS) Kabupaten Tolitoli (2024)

MATERIALS AND METHODS

Study area and period

The study was conducted in Tolitoli District, Central Sulawesi Province, Indonesia, focusing on Ogodeide and Basidondo Sub-districts. The study sites were selected purposively based on coordination with the local Agricultural Office and regional production records, which indicate that both sub-districts contribute substantially to bird's eye chili and curly chili production in the regency. Moreover, both sub-districts were proposed as "Kampung Cabai" (Chili Village) development areas in 2021-2022, and Ogodeide remains a designated horticultural development zone.

Agroecologically, the study area is characterized by lowland to moderately elevated terrain, average temperatures ranging from approximately 25-30°C, and relatively high annual rainfall, providing favorable conditions for chili cultivation. These conditions support continuous production and reinforce the region's potential for agribusiness development.

The research was conducted from November 2025 to January 2026. The object of the study was the chili agribusiness system, covering input supply, farm-level production, post-harvest handling, marketing, and supporting institutions.

Figure 2 presents the geographical location of the study area. The map was prepared using ArcGIS Desktop version 10.3 for spatial visualization.

Research design

This study employed a descriptive-exploratory mixed-methods design integrating qualitative and quantitative approaches (Creswell and Plano Clark 2018). The qualitative phase involved in-depth interviews and field observations to identify internal and external factors influencing chili agribusiness development. Interview data were transcribed, coded, and organized to generate an initial list of strategic factors, which were subsequently refined through data reduction and validated using source triangulation among key informants.

The validated factors were then transformed into quantitative data through structured questionnaires using a Likert scale to assess their relative importance. The quantitative phase involved weighting, scoring, and evaluating these factors within a multi-criteria decision-making framework, enabling a systematic transition from qualitative exploration to quantitative analysis.

The integrated analytical framework comprised the Internal Factor Evaluation (IFE) matrix, External Factor Evaluation (EFE) matrix, Grand Strategy Matrix, and SWOT analysis for strategy formulation, followed by the Analytical Hierarchy Process (AHP) for prioritization. This design ensures a coherent linkage between factor identification, strategic positioning, alternative formulation, and priority determination within the regional agribusiness system.

Data collection and respondents

The data used consists of primary and secondary sources. Primary data were collected through in-depth interviews, field observations, and structured questionnaires administered to purposively selected informants based on their knowledge, experience, and involvement in chili agribusiness development. In qualitative research, informant selection emphasizes information richness rather than statistical representation (Patton 2002).

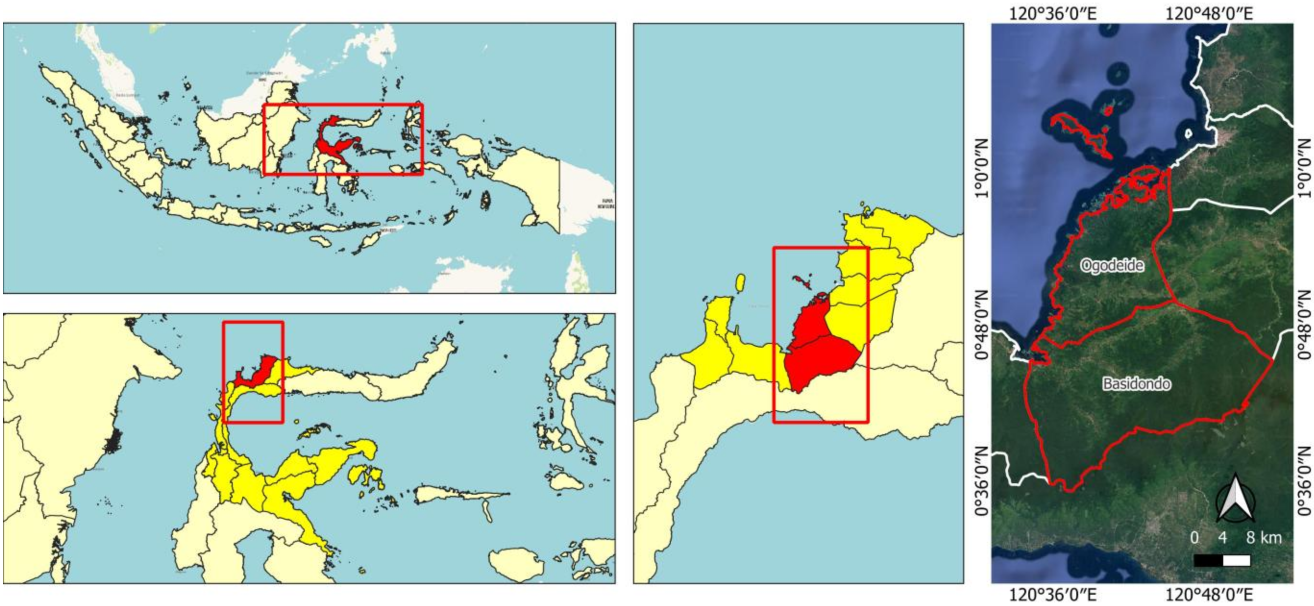

Figure 2. Map of research locations in Tolitoli District, Central Sulawesi Province, Indonesia

A total of 16 individuals participated as key informants, of whom 14 were involved in identifying and evaluating internal and external factors for the IFE, EFE, Grand Strategy, and SWOT analyses, representing farmers, agribusiness actors, extension officers, traders, and local government stakeholders. In addition, three experts were involved in the Analytical Hierarchy Process (AHP) assessment, selected based on their authority and expertise in agribusiness planning and regional agricultural policy. One of these experts was also included among the initial informants; however, their involvement in the AHP stage was conducted independently from the earlier qualitative assessment to avoid potential bias and ensure objectivity.

The use of three experts is considered adequate in AHP studies when participants possess high domain expertise and decision-making authority. The AHP method does not require a large sample size for statistical validity, as it relies on expert judgment rather than population-based inference (Nguyen et al. 2022). Previous studies have also shown that AHP applications typically involve small expert panels, depending on the research context (Misran et al. 2020; Raišienė and Raišys 2022). Each expert completed the pairwise comparison independently, and group judgments were aggregated using the geometric mean. Consistency ratios were calculated to ensure that the results met the acceptable threshold ($CR \leq 0.10$).

Secondary data were obtained from official government reports, statistical publications, and relevant previous studies. The detailed composition of respondents is presented in Tables 1 and 2.

Table 1. Categories of respondents / key informants for IFE, EFE, grand strategy, and SWOT analyses

Respondent category	Number	Role in chili agribusiness	Rationale for selection
Secretary of the Food Crops and Horticulture Office	1	Operational and technical policymaker for horticulture	Extensive experience in the horticulture sector; previously served as Head of the Vegetable Crops Section and Head of the Horticultural Production Division, with in-depth understanding of chili related technical and policy issues
Head of Horticultural Production Division	1	Technical authority responsible for horticultural production, including chili	Demonstrated expertise in chili production and development
Agricultural Product Quality Supervisor	1	Ensures quality standards of horticultural products	Familiar with quality standards and market requirements
Plant Seed Supervisor	1	Ensures availability of certified and quality seeds	Possesses knowledge of production input issues
Experienced Chili Farmers (≥10 years; two per sub-district)	4	Primary actors in chili cultivation	Provide insights into actual on-farm conditions and production challenges
Agricultural Input Supplier	1	Supplies seeds, fertilizers, pesticides, and other inputs	Understands input distribution systems and associated constraints
Collector Trader	1	Aggregates chili produce from farmers	Has in-depth knowledge of distribution chains, pricing mechanisms, and market dynamics
Retail Trader	1	Sells chili directly to consumers	Understands consumer demand patterns and market preferences
Field Agricultural Extension Officers	2	Provide on-site technical assistance to farmers	Familiar with technology adoption challenges and cultivation problems
Chili Processing Business Actor	1	Processes chili into value-added products (e.g., chili paste, powder, sauces)	Provides perspectives on downstream development, value addition, and market potential of processed chili products
Total	14		

Table 2. Categories of expert respondents for the AHP analysis

Expert respondent	Number	Role / expertise	Rationale for selection
Head of the Food Crops and Horticulture Office	1	Strategic decision-maker in the regional agricultural sector	Has formal authority to determine policy directions for horticultural development, particularly chili
Secretary of the Food Crops and Horticulture Office	1	Technical and operational supervisor of horticultural development	Extensive experience in horticulture (former Head of Vegetable Crops Section and Head of Horticultural Production Division), with in-depth technical knowledge of chili cultivation and development
Agribusiness Academic	1	Academic expert in agribusiness management	Provides a scientific perspective and enhances objectivity in the determination of AHP priority weights
Total	3		

Data analysis

Data analysis was conducted in a sequential and integrated manner. Internal (strengths and weaknesses) and external (opportunities and threats) factors were identified through qualitative analysis and subsequently evaluated using the Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) matrices, as commonly applied in strategic management studies (David 2011; Etongo et al. 2023).

The weighting and rating process in the IFE and EFE matrices relied on expert judgment from individuals with a comprehensive understanding of technical conditions, institutional dynamics, and regional agricultural development. Three expert panelists were purposively selected from the 14 key informants based on their authority and competence in agribusiness decision-making to assign weights and ratings. The importance scores provided by the experts were first averaged and then normalized to obtain the relative weight of each factor, expressed as:

$$W_i = \frac{\bar{X}_i}{\sum_{i=1}^{n} \bar{X}_i}$$

Where, W_i represents the normalized weight of factor i, $\bar{X}_i$ is the average importance score assigned by the experts, and n is the total number of factors. The normalized weights were ensured to sum to 1.00 within each matrix.

Ratings were assigned using a four-point scale. For the IFE matrix: 1 = major weakness, 2 = minor weakness, 3 = minor strength, and 4 = major strength. For the EFE matrix: 1 = poor response to the external factor, 2 = below-average response, 3 = above-average response, and 4 = superior response. The weighted score for each factor was calculated as:

$$S_i = w_i \times r_i$$

Where, S_i is the weighted score of factor i, w_i is the normalized weight, and r_i is the rating assigned to the factor.

The total IFE and EFE scores were used to determine the strategic position in the Grand Strategy Matrix, which evaluates internal strength and market growth conditions to guide strategic direction (David 2011). Based on the identified strategic position, alternative strategies were formulated using SWOT analysis by systematically combining internal and external factors (David 2011).

The final stage employed the Analytical Hierarchy Process (AHP) to determine priority strategies (Saaty 2008), implemented using Expert Choice software version 11 to facilitate pairwise comparisons, priority synthesis, and consistency evaluation. Pairwise comparisons were conducted using Saaty's 1–9 scale, and group judgments were aggregated using the geometric mean. The global priority of each alternative was calculated as a weighted sum of its local priorities across all criteria. The consistency of judgments was evaluated using the Consistency Ratio (CR), with an acceptable threshold of $CR \leq 0.10$.

RESULTS AND DISCUSSION

Characteristics of research respondents

The characteristics of respondents indicate that the selected informants possess relevant experience and knowledge in chili agribusiness activities. The majority of respondents have been involved in farming, trading, or agricultural services for several years, reflecting a strong understanding of production practices, market dynamics, and institutional conditions.

In terms of educational background, most respondents have completed at least secondary education to a bachelor's degree, supporting their ability to provide informed and consistent judgments. In addition, respondents represent key actors within the agribusiness system, including farmers, traders, extension officers, and government stakeholders, ensuring a comprehensive perspective across the value chain. These characteristics confirm that the respondents are well-qualified to provide reliable information for identifying internal and external factors and supporting strategic analysis in this study.

Results of Internal and External Factor Analysis (IFE-EFE)

The analysis of internal and external factors indicates that chili agribusiness development in Tolitoli District is shaped by the interaction of strengths, weaknesses, opportunities, and threats within the agribusiness system. This approach is consistent with strategic frameworks emphasizing systematic identification of internal and external conditions to enhance competitiveness and capitalize on market opportunities (Patima et al. 2024).

At the preliminary stage, a total of 40 factors (20 internal and 20 external) were identified through in-depth interviews and field observations involving 14 key informants. These factors were then assessed using a five-point Likert scale to measure their perceived relevance and influence on chili agribusiness conditions in the field. The average scores were subsequently ranked, and factor selection was determined based on the highest-ranking values.

Conceptual considerations, including factor relevance and non-overlapping meaning, had been addressed during the initial identification stage through qualitative interviews and expert-informed screening. Therefore, the filtering process at this stage relied primarily on quantitative ranking to retain the most significant factors. As a result, five strengths and five weaknesses were selected for internal factors, and five opportunities and five threats were selected for external factors, resulting in 10 internal and 10 external strategic factors, which were subsequently structured into the Internal Factor Evaluation (Table 3) and External Factor Evaluation (Table 4) matrices.

Table 3. Internal Factor Evaluation (IFE) matrix

Internal Strategic Factors	**Weight**	**Rating**	**Score**
Strengths			
S1: Potential for chili development as a regional leading commodity	0.13	4	0.52
S2: Stable and easily accessible domestic market	0.12	4	0.48
S3: Availability of relatively extensive potential agricultural land	0.13	3	0.39
S4: Partial adoption of basic cultivation technologies (mulching and balanced fertilization)	0.12	4	0.48
S5: Chili as a strategic and priority commodity in regional development	0.08	3	0.24
Total Strength Score			2.11
Weaknesses			
W1: Underdeveloped post-harvest processing and weak downstream integration (limited value addition)	0.10	1	0.10
W2: High incidence of pests and diseases	0.10	2	0.20
W3: Predominant use of traditional practices and low technology adoption among farmers	0.07	2	0.14
W4: High and relatively unaffordable costs of fertilizers and pesticides	0.07	2	0.14
W5: Inadequate and suboptimal seed quality supervision	0.08	2	0.16
Total Weakness Score			0.74
Total Internal Factor Score	1.00		2.85

Source: Primary data analysis (2025)

Table 4. External Factor Evaluation (EFE) matrix

External Strategic Factors	**Weight**	**Rating**	**Score**
Opportunities			
O1: Increasing market demand for chili	0.13	3	0.39
O2: Favorable climatic and soil conditions for chili development	0.15	3	0.45
O3: Export opportunities to regions outside Sulawesi	0.07	3	0.21
O4: Access to financing through banks, cooperatives, and agricultural credit schemes (KUR)	0.10	3	0.30
O5: Availability of supporting agricultural inputs	0.11	3	0.33
Total Opportunity Score			1.68
Threats			
T1: High chili price volatility contributing to regional inflation	0.08	2	0.16
T2: Climate variability affecting planting seasons and production yields	0.11	2	0.22
T3: Limited agricultural infrastructure	0.07	2	0.14
T4: Limited private sector investment in the chili agribusiness sector	0.08	2	0.16
T5: Pest and disease infestations	0.10	2	0.20
Total Threat Score			0.88
Total External Factor Score	1.00		2.56

Source: Primary data analysis (2025)

The Internal Factor Evaluation (IFE) results indicate that key strengths include favorable agroecological conditions, market access, land availability, and farmer experience, while major weaknesses relate to low productivity, limited technology adoption, weak institutions, and minimal downstream processing. The total IFE score above 2.50 suggests that internal strengths outweigh weaknesses, reflecting a relatively strong internal strategic position.

The External Factor Evaluation (EFE) results show that opportunities arise from increasing market demand, supportive agroecological conditions, access to financing, and export potential, particularly in the form of interregional market expansion driven by rising demand from areas outside the region. Meanwhile, major threats include price volatility, pest and disease risks, climate variability, and limited supporting infrastructure. The total EFE score above the average benchmark indicates that opportunities outweigh threats, although effective risk management remains necessary.

Overall, these results indicate that chili agribusiness in Tolitoli District operates under relatively strong internal conditions and a favorable external environment. This provides a basis for determining strategic positioning in the Grand Strategy Matrix and supports the formulation of development strategies that leverage internal strengths to capitalize on external opportunities.

Strategic position based on the grand strategy matrix

The strategic position of chili agribusiness development was determined using the Grand Strategy Matrix based on total IFE and EFE scores. The horizontal axis (X) represents competitive position derived from the total IFE score, while the vertical axis (Y) represents market growth derived from the total EFE score. The benchmark value of 2.50 was used to distinguish strong and weak positions.

The coordinates were calculated as:

X Coordinate = Total IFE Score
Y Coordinate = Total EFE Score

Based on the results of the IFE and EFE analyses, the total IFE and EFE scores were 2.85 and 2.56, respectively, resulting in coordinates (2.85; 2.56). As both values exceed the benchmark of 2.50, the position falls within Quadrant I, indicating a strong competitive position and favorable market growth conditions. This quadrant recommends growth-oriented strategies that leverage internal strengths to capitalize on external opportunities (David and David 2017).

Although the scores are only slightly above the threshold, this positioning remains strategically meaningful in the context of Tolitoli District. In developing agribusiness systems, even moderate scores above the average reflect sufficient internal capacity and emerging external opportunities. Existing strengths such as agroecological suitability, land availability, and farmer experience provide a foundation for expansion, while increasing demand, particularly from interregional markets, reinforces growth potential. This interpretation is consistent with Anggorowati et al. (2022), who emphasize that regions with strong internal capacity and favorable external conditions should pursue expansion-oriented strategies.

Institutional limitations and productivity constraints do not negate this position but instead highlight areas requiring strengthening. Therefore, the Quadrant I position justifies the adoption of proactive and context-sensitive growth strategies. The strategic position is illustrated in Figure 3.

Formulation of alternative strategies using the SWOT analysis

Based on the SWOT analysis, chili agribusiness development in Tolitoli District demonstrates strong growth potential by leveraging internal strengths to capitalize on external opportunities. Consistent with its Quadrant I position in the Grand Strategy Matrix, S-O and W-O strategies constitute the primary strategic directions, while S-T and W-T strategies function as complementary risk-mitigation measures. Internal and external factors were coded (S1-Sn; W1-Wn; O1-On; T1-Tn) consistently with the IFE and EFE matrices to ensure traceability in strategy formulation.

S-O strategies emphasize the development of area-based chili production centers aligned with agroclimatic suitability and rising market demand, alongside productivity enhancement through improved cultivation practices and policy support. W-O strategies focus on strengthening farmer institutions, expanding access to technological innovation, and improving market linkages to address structural weaknesses. These findings align with Sultan et al. (2024) and Ariyantini et al. (2025), who argue that S-O and W-O strategies are most appropriate for agribusiness systems characterized by strong internal capacity and favorable external conditions. Meanwhile, S-T and W-T strategies are designed to mitigate risks related to price volatility, supply instability, and climatic uncertainty. All strategic alternatives were screened for feasibility and redundancy. This process resulted in a refined set of key strategies (Table 5), which were then prioritized using the Analytical Hierarchy Process (AHP).

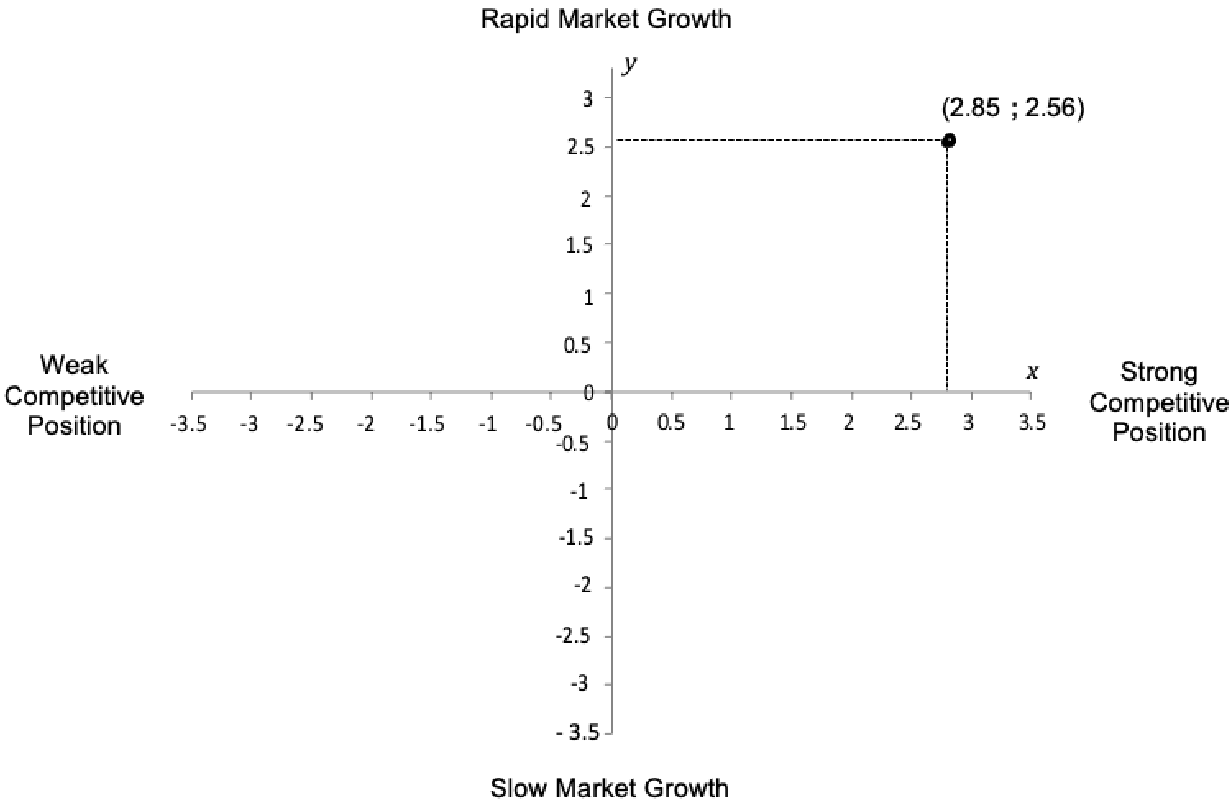

Figure 3. Grand strategy matrix graph

Analytical Hierarchy Process (AHP) analysis: Chili agribusiness development strategies in Tolitoli District

AHP hierarchical structure

The Analytical Hierarchy Process (AHP) was employed to determine priority strategies based on a structured multi-criteria framework widely applied in agricultural development studies to support decision-making based on stakeholder preferences (Baffoe 2019). Following Saaty's hierarchical principles (Saaty 1993), the model was organized into three levels: (i) The overall goal, (ii) Evaluation criteria, and (iii) Alternative strategies. The goal is to determine priority strategies for chili agribusiness development in Tolitoli District.

The second level comprises four evaluation criteria: economic impact, implementation feasibility, institutional support, and sustainability and risk. These criteria were established based on empirical findings from the IFE-EFE and SWOT analyses, reflecting key structural constraints in the study area and representing economic performance, technical feasibility, institutional capacity, and long-term sustainability of the agribusiness system.

The third level consists of seven alternative strategies derived from the SWOT analysis, representing feasible and context-specific interventions to enhance agribusiness performance and competitiveness. This hierarchical structure ensures a systematic linkage between strategic objectives, evaluation criteria, and alternative strategies.

Pairwise comparisons were conducted individually by three purposively selected experts representing policy, technical, and academic perspectives. Each expert completed structured pairwise comparison questionnaires using Saaty's 1-9 fundamental scale (Saaty 1993). Individual judgments were aggregated using the geometric mean to obtain a group comparison matrix, and consistency was evaluated using the Consistency Ratio (CR), with an acceptable threshold of CR $\leq$ 0.10. The hierarchical structure of the AHP model used in this study is illustrated in Figure 4.

Table 5. Alternative strategies for chili agribusiness development based on the SWOT matrix

SWOT	Alternative Strategy	Code
S-O Strategy	Develop chili production centers based on land potential and increasing market demand (S1, S3, S5-O1, O3)	A1
	Expand interregional market access and explore chili export opportunities through strengthened distribution networks (S2, S5-O3)	A2
	Enhance chili production by optimizing cultivation technologies already adopted by farmers (S4-O2, O5)	A3
W-O Strategy	Develop chili processing industries (downstream value addition) to increase value added and stabilize farmers' income (W1-O1, O3)	A4
	Improve farmers' access to financing by utilizing agricultural credit schemes (KUR) and cooperatives to address capital constraints (W4-O4)	A5
S-T Strategy	Optimize the role of farmer institutions in maintaining supply stability to mitigate the impact of chili price volatility (S2, S5-T1, T4)	A6
W-T Strategy	Promote the adoption of Integrated Pest Management (IPM) to reduce the risk of crop failure due to pest and disease outbreaks (W2, W3-T2, T5)	A7

Source: Primary data analysis (2025)

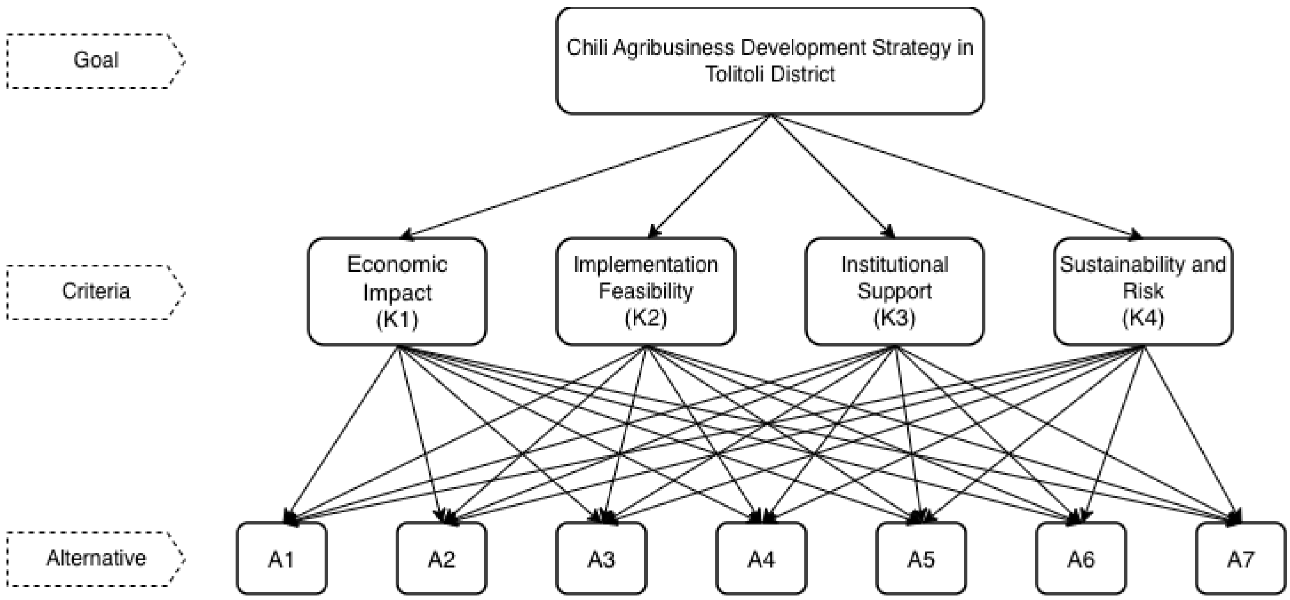

Figure 4. AHP hierarchical structure

Determination of criteria weights for chili agribusiness development

The criteria weighting results indicate that institutional support has the highest priority weight (0.479) (Figure 5), highlighting its critical role in determining the success of chili agribusiness development in Tolitoli District. This reflects the importance of institutional coordination and synergy among agribusiness actors in integrating upstream–downstream subsystems.

Although institutional factors were not the most dominant weakness in the IFE matrix, their prominence in the AHP results indicates their role as a key enabling factor for effective strategy implementation. While the IFE captures current conditions, AHP reflects the relative importance of criteria for future strategic priorities. In this context, institutional support functions as a leverage factor in strengthening coordination, improving access to inputs and markets, and facilitating program implementation.

Conceptually, institutional strengthening is essential for sustainable agribusiness development as it enables the integration of information, capital, and innovation flows (Rico et al. 2024). Empirically, chili agribusiness in Tolitoli District remains constrained by weak coordination and limited institutional roles, resulting in suboptimal dissemination of market information and technology. Therefore, institutional support emerges as the most influential factor affecting policy implementation, technology adoption, and market integration, consistent with Novita et al. (2024b). The Consistency Ratio (CR) of 0.00638 indicates a high level of consistency (CR ≤ 0.10), confirming the reliability of the weighting results.

Pairwise comparison of alternative strategies based on the economic impact criterion

Based on the AHP results generated using Expert Choice version 11, the strategy of enhancing production ranks first under the economic impact criterion, with a priority weight of 0.283 (Table 6), indicating its strong contribution to improving farmer income and overall agribusiness performance in Tolitoli District, where productivity remains below provincial and national averages.

Production enhancement is considered a short- to medium-term intervention capable of increasing output, stabilizing supply, and improving production efficiency, which are key drivers of competitiveness in agricultural value chains (Porter 1990). This finding is consistent with Faisol et al. (2022), who emphasize the role of productivity improvement in strengthening regional horticultural economies. Given the existing constraints in productivity and technology adoption, this strategy is perceived to yield more immediate economic returns compared to other alternatives.

The development of agro-processing industries ranks second (0.164), reflecting its role in extending the value chain and generating additional value added. As reliance on fresh-market sales exposes farmers to price volatility, processing activities are considered important for enhancing income stability and regional competitiveness (Lukas et al. 2023). In contrast, the lower priority assigned to Integrated Pest Management (IPM) indicates that, although important for sustainability, its economic benefits are relatively indirect and longer-term, making it less prioritized under this criterion.

Pairwise comparison of alternative strategies based on the implementation feasibility criterion

The development of chili production centers ranks first under the implementation feasibility criterion, with a priority weight of 0.244 (Table 7), indicating its strong practicality under existing local conditions in terms of resource availability, institutional coordination, and technical readiness. Area-based production development enables more coordinated land use, input distribution, extension services, and market access, thereby reducing operational complexity at the field level.

Table 6. Priority weights of alternative strategies based on the economic impact criterion

Alternative strategies	Priority weight	Inconsistency*
(A1) Development of chili production centers	0.111	0.02
(A2) Expansion of interregional market access	0.129	
(A3) Enhancement of chili production	0.283	
(A4) Development of chili processing industries (value-added downstreaming)	0.164	
(A5) Improvement of farmers' access to financing	0.121	
(A6) Optimization of farmer institutional roles	0.129	
(A7) Promotion of Integrated Pest Management (IPM) adoption	0.062	

Note: AHP results based on expert judgment (n = 3) using Expert Choice v.11; CR ≤ 0.10. *: Inconsistency refers to the overall Consistency Ratio (CR) of the pairwise comparison matrix for the Economic Impact criterion. Source: Primary data analysis (2026)

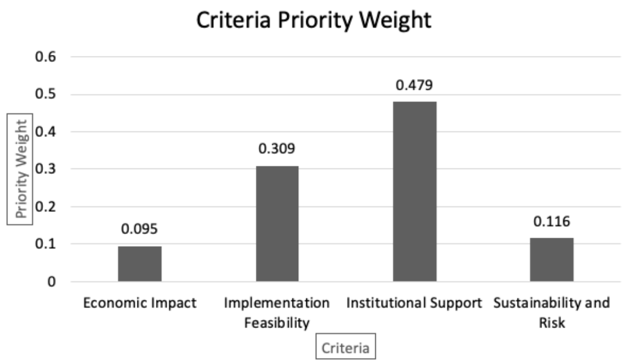

Figure 5. Criteria weights based on AHP analysis. Note: Values above bars represent normalized priority weights. Source: Primary data analysis using Expert Choice v.11 (2026)

This finding is consistent with Saptana et al. (2022), who demonstrate that cluster-based development enhances efficiency and institutional integration. In Tolitoli District, where agroecological suitability and farmer concentration are already present, this strategy is considered technically and institutionally feasible in the short to medium term.

Enhancing production ranks second (0.215), reflecting its feasibility through incremental improvements in cultivation practices, including improved seed use, balanced fertilization, irrigation management, and protective technologies. With adequate extension support, this approach is operationally manageable and capable of delivering relatively rapid benefits. In contrast, the lower priority assigned to Integrated Pest Management (IPM) (0.062) indicates that, despite its ecological importance, implementation remains constrained by limited farmer capacity, behavioral adaptation challenges, and the need for stronger institutional support, positioning it as a longer-term intervention.

Pairwise comparison of alternative strategies based on the institutional support criterion

Optimizing the role of farmer institutions ranks first under the institutional support criterion, with a priority weight of 0.291 (Table 8), highlighting the central role of institutional capacity in strengthening coordination, bargaining power, and access to inputs, finance, and markets. In Tolitoli District, strengthening farmer groups and farmer group associations (Gapoktan) is considered a strategic prerequisite for improving production synchronization, accelerating technology adoption, and stabilizing supply through coordinated cropping, storage, and marketing. Strong institutional structures enhance collective efficiency and facilitate access to productive resources, ultimately contributing to farmer welfare (Wijana and Setiawina 2021).

The development of chili production centers ranks second (0.178), reflecting its dependence on effective coordination among agricultural agencies, farmer organizations, and financial institutions. Without institutional alignment, spatial production concentration may not achieve its intended efficiency gains. In contrast, the lower priority assigned to agro-processing development (0.063) indicates that downstream expansion remains constrained by limited policy support, financing mechanisms, and post-harvest infrastructure, emphasizing the need to strengthen institutional capacity as a foundation for other development initiatives.

Pairwise comparison of alternative strategies based on the sustainability and risk criterion

The development of chili production centers ranks first under the sustainability and risk criterion, with a priority weight of 0.272 (Table 9), indicating that long-term sustainability in Tolitoli District depends on a systemic, area-based approach integrating production management, institutional coordination, and risk mitigation. This strategy enhances resilience through coordinated cultivation practices, efficient input use, and the adoption of environmentally sound farming systems within designated production areas. Such spatial integration supports supply stability and strengthens adaptive capacity against climatic and market uncertainties, consistent with Kusmiati et al. (2025), who highlight the role of cluster-based development in improving supply chain resilience and logistical efficiency.

Table 7. Priority weights of alternative strategies based on the implementation feasibility criterion

Alternative strategies	Priority weight	Inconsistency*
(A1) Development of chili production centers	0.244	0.03
(A2) Expansion of interregional market access	0.123	
(A3) Enhancement of chili production	0.215	
(A4) Development of chili processing industries (value-added downstreaming)	0.107	
(A5) Improvement of farmers' access to financing	0.150	
(A6) Optimization of farmer institutional roles	0.099	
(A7) Promotion of Integrated Pest Management (IPM) adoption	0.062	

Note: AHP results based on expert judgment (n = 3) using Expert Choice v.11; CR ≤ 0.10. *: Inconsistency refers to the overall Consistency Ratio (CR) of the pairwise comparison matrix for the Implementation Feasibility criterion. Source: Primary data analysis (2026)

Table 8. Priority weights of alternative strategies based on the institutional support criterion

Alternative strategies	Priority weight	Inconsistency*
(A1) Development of chili production centers	0.178	0.03
(A2) Expansion of interregional market access	0.120	
(A3) Enhancement of chili production	0.123	
(A4) Development of chili processing industries (value-added downstreaming)	0.063	
(A5) Improvement of farmers' access to financing	0.149	
(A6) Optimization of farmer institutional roles	0.291	
(A7) Promotion of Integrated Pest Management (IPM) adoption	0.075	

Note: AHP results based on expert judgment (n = 3) using Expert Choice v.11; CR ≤ 0.10. *: Inconsistency refers to the overall Consistency Ratio (CR) of the pairwise comparison matrix for the Institutional Support criterion. Source: Primary data analysis (2026)

Enhancing production ranks second (0.193), as productivity improvement contributes to supply stability and reduces vulnerability to price fluctuations and climate-related risks through the adoption of sustainable practices and risk-reducing technologies. In contrast, the lower priority assigned to expanding market access (0.065) indicates that, although economically beneficial, it is perceived as less directly linked to system stability and may introduce additional risks, including price volatility, high logistics costs, and dependence on external markets. Therefore, strengthening the production base and institutional capacity is prioritized before pursuing broader market expansion.

Determination of priority strategies for chili agribusiness development

Based on the AHP synthesis, the final priority ranking was obtained by aggregating local priorities of each alternative across all criteria, weighted by their relative importance. The results show that the strategy of developing chili production centers based on land potential and increasing market demand (A1) has the highest global weight (0.205), followed by optimizing farmer institutional roles (A6 = 0.196) and enhancing chili production (A3 = 0.178) (Table 10). The overall Consistency Ratio (CR) of 0.02 is well below the acceptable threshold (CR ≤ 0.10), confirming that the aggregated expert judgments are consistent and reliable.

The prioritization of A1 reflects a cluster-oriented, area-based development approach that integrates spatial organization and institutional coordination among agribusiness actors. This strategy strengthens production management, improves supply consistency, and enhances value chain efficiency, consistent with Saptana et al. (2022). In addition, Novita et al. (2024a) emphasize that sustainable chili agribusiness development depends on the integration of land potential utilization, institutional strengthening, and responsiveness to market demand.

From a contextual perspective, Tolitoli District possesses favorable agroclimatic conditions and sufficient land resources for chili cultivation. Accordingly, strengthening area-based production systems is identified as the strategic foundation for agribusiness development, supported by complementary strategies such as productivity enhancement, institutional strengthening, and downstream development, which can be progressively implemented.

Figure 6 presents the complete AHP hierarchy, including the relative weights of criteria and alternative strategies. At the criteria level, institutional support emerges as the most influential dimension, highlighting the importance of coordinated institutional arrangements. At the alternative level, A1 shows consistent dominance across multiple criteria, particularly under implementation feasibility and sustainability and risk, while A6 performs strongly under institutional support. This pattern indicates that the selected strategies demonstrate consistent performance across technical, institutional, and risk-related dimensions.

Overall, the AHP synthesis is illustrated in Figure 6. This figure shows the hierarchical structure linking the goal, evaluation criteria, and alternative strategies.

Table 9. Priority weights of alternative strategies based on the sustainability and risk criterion

Alternative strategies	Priority weight	Inconsistency*
(A1) Development of chili production centers	0.272	0.02
(A2) Expansion of interregional market access	0.065	
(A3) Enhancement of chili production	0.193	
(A4) Development of chili processing industries (value-added downstreaming)	0.106	
(A5) Improvement of farmers' access to financing	0.083	
(A6) Optimization of farmer institutional roles	0.173	
(A7) Promotion of Integrated Pest Management (IPM) adoption	0.107	

Note: AHP results based on expert judgment (n = 3) using Expert Choice v.11; CR ≤ 0.10. *: Inconsistency refers to the overall consistency ratio (CR) of the pairwise comparison matrix for the Sustainability and Risk criterion. Source: Primary data analysis (2026)

Table 10. Priority strategies for chili agribusiness development based on the AHP

Alternative strategies	Priority weight	Inconsistency*
(A1) Development of chili production centers	0.205	0.02
(A2) Expansion of interregional market access	0.115	
(A3) Enhancement of chili production	0.178	
(A4) Development of chili processing industries (value-added downstreaming)	0.093	
(A5) Improvement of farmers' access to financing	0.139	
(A6) Optimization of farmer institutional roles	0.196	
(A7) Promotion of Integrated Pest Management (IPM) adoption	0.073	

Note: AHP synthesis results based on expert judgment (n = 3) using Expert Choice v.11; CR ≤ 0.10. *: Inconsistency represents the overall consistency ratio (CR) of the AHP synthesis matrix used to derive the final priority weights of alternative strategies. Source: Primary data analysis (2026)

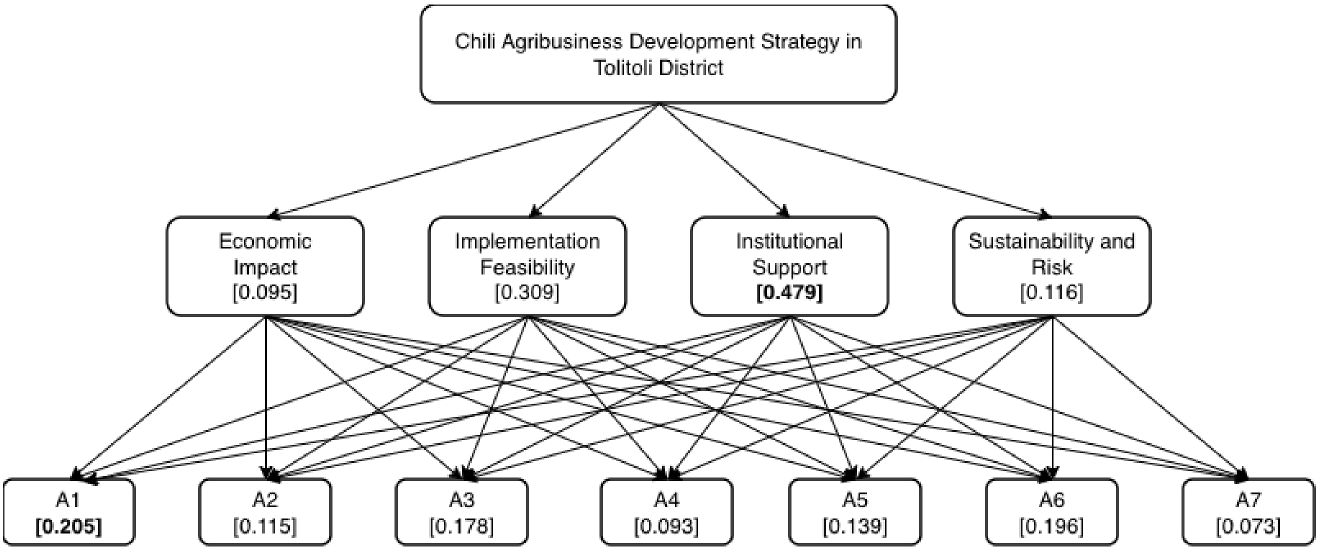

Figure 6. Overall weight value of strategic priorities in the AHP hierarchical structure

Discussion and policy implications

The prioritization of institutional support and area-based chili production centers in Tolitoli District indicates a structural coordination challenge rather than solely a productivity constraint. The results from internal and external factor analysis suggest that weak coordination among agribusiness actors particularly farmers, traders, extension services, and local government is associated with fragmented production decisions, asynchronous planting patterns, unstable supply volumes, and recurring price volatility. Based on stakeholder perceptions obtained during interviews, institutional limitations are indicated to amplify production fluctuations, where periods of oversupply during peak harvest may be followed by temporary shortages triggered by pest outbreaks or climatic disturbances.

Strengthening farmer institutions is therefore viewed as a stabilizing mechanism operating through several interrelated channels. In comparable agribusiness systems, institutional collaboration and value-chain coordination are widely recognized as key factors supporting smallholder development (Devaux et al. 2018; Saptana et al. 2022). First, coordinated planting schedules within designated production areas can help stabilize aggregate supply and reduce seasonal price fluctuations. Second, collective marketing through farmer groups enhances bargaining power by consolidating volumes and improving access to market information, thereby reducing dependence on intermediary traders. Third, improved institutional access to extension services and financing is associated with better technology adoption, more stable yields, and reduced production risk. In this context, institutional strengthening functions as a linkage between production planning, market coordination, and risk management, consistent with findings by Rico et al. (2024).

The emergence of area-based chili production centers as the top global priority further reflects the need for spatially coordinated development. This approach can be understood as a cluster-based framework that integrates production management and institutional coordination within designated areas. Spatial concentration enables more efficient allocation of extension services, irrigation support, pest monitoring, and infrastructure investment, while also facilitating synchronized supply planning. Similar patterns have been observed in horticultural development in peripheral regions of Indonesia, where cluster-based approaches are associated with improved coordination and supply chain efficiency (Wardhono et al. 2021; Novita et al. 2024a).

From a sequencing perspective, strengthening the production base is considered a necessary foundation before expanding market access or processing capacity. Without stable production, downstream expansion may increase exposure to price volatility and logistical constraints. This suggests that area-based development, supported by institutional strengthening, provides a more robust pathway toward sustainable chili agribusiness development in Tolitoli District.

Implementation roadmap

The implementation roadmap presented in this study is derived interpretatively from the prioritized strategies identified through the AHP and SWOT analyses, serving as a structured translation of analytical results into sequential and actionable development stages.

To operationalize these strategies, a phased implementation pathway is proposed:

In the short term (1-2 years), the focus is on institutional consolidation and production coordination, including: (i) The formalization of designated chili production zones based on land suitability, (ii) Consolidation and strengthening of farmer groups and economic organizations, (iii) Synchronization of planting calendars and improved dissemination of market information and (iv) Expansion of access to agricultural credit schemes (KUR).

In the medium term (3-5 years), the emphasis shifts to productivity improvement and value-chain strengthening. This includes: (i) The gradual intensification of cultivation technologies within production clusters, such as improved seed supervision, balanced fertilization, and pest monitoring systems, (ii) The development of collective storage and post-harvest handling facilities to reduce distress sales, (iii) Introducing pilot-scale processing units once supply stability is achieved and (iv) Strengthened interregional marketing partnerships through institutional arrangements. This sequencing reflects the study's core findings that downstream expansion and market development should follow institutional consolidation and production stabilization.

Risk factors and mitigation strategies

Several contextual risks may influence the implementation of priority strategies. Therefore, targeted mitigation measures are required and should be aligned with the AHP results.

First, climate variability and extreme rainfall may disrupt production stability. Mitigation measures aligned with the development of area-based production centers (A1) include cluster-level crop scheduling, improved drainage systems, and coordinated pest surveillance.

Second, pest and disease outbreaks represent a significant production risk. These can be mitigated through the adoption of Integrated Pest Management (IPM), as reflected in strategy A7, which aims to reduce crop failure risk through coordinated and environmentally sound pest control practices.

Third, infrastructure limitations, including constraints in roads, storage, and irrigation, may hinder effective implementation. Addressing these constraints linked to area-based development (A1) and access to financing mechanisms (A5) requires prioritizing infrastructure investment within designated production centers.

Fourth, market dependence and price volatility may affect income stability. Mitigation efforts aligned with strategies A6 (institutional strengthening) and A2 (market expansion) include improved market coordination, supply planning, and diversification of market access.

By linking institutional coordination, spatial production planning, and risk management, this study indicates that chili agribusiness development in Tolitoli District requires systemic restructuring rather than isolated production enhancement. The prominence of institutional support in the AHP hierarchy highlights governance quality as a key leverage point for stabilizing supply, reducing volatility, and improving farmer welfare. Accordingly, policy effectiveness depends not only on increasing production, but also on appropriately sequencing institutional strengthening and production clustering prior to expanding market access and downstream processing.

In conclusion, this study demonstrates that chili agribusiness development in Tolitoli District requires a coordinated strategy emphasizing institutional strengthening and area-based production management. The integrated application of IFE–EFE analysis, the Grand Strategy Matrix, SWOT, and the Analytical Hierarchy Process (AHP) has proven effective in providing a systematic framework for identifying strategic priorities aligned with local empirical conditions. Institutional support emerged as the most influential criterion, while the development of area-based chili production centers based on land potential and increasing market demand was identified as the highest priority strategy. These findings suggest that strengthening institutional coordination, synchronizing production planning, and promoting cluster-based agribusiness development are essential for improving supply stability, reducing price volatility, and enhancing long-term competitiveness. This study contributes to agribusiness planning literature by demonstrating the practical application of an integrated multi-criteria decision-making framework that systematically links strategic diagnosis, formulation, and prioritization within a regional development context.

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